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FISHERMEN OF FRANCE.

FRENCH FISHING PORT.

In traversing the French coast from north to south, from Dunkirk to the Alps, we find it inhabited successively by Flemings, Normans, Bretons, Basques, or Biscayans, and the men of Languedoc and Provence. Much as these differ in point of origin and language, they remarkably resemble each other in their habits and daily occupations. The whole of the French coast provides seamen for the royal navy, and masters and pilots for merchant vessels, as well as dockyard men for the arsenals; and while the male population is engaged in one or other of these employments, or in the coasting-trade and fisheries, the women, old men and children, remain at home, attending to the culture of the ground and harvest-work. When the return of Winter brings them all together, the old boats are repaired, new ones built, and nets are manufactured.

It has been remarked, however, that although the whole line of the French coast supplies seamen, all do not possess the same qualities. The men of Provence and Gascony are the most active and the most intelligent; the Bretons the steadiest, the hardiest, and the stoutest. A French admiral, Grivel, considers the inhabitants of ancient Armorica, now Brittany, to be peculiarly fitted for the sea.

The seaman, when ashore, carries into his family habits and manners quite his own. The house he occupies is generally cleaner than those belonging to landsmen of the same rank in life who only till the soil. He wears also on his countenance an expression of seriousness approaching to melancholy, indicating a life exposed to risks and difficulties.

The inhabitants of the French coast, from the simple fact of their geographical position, as soon as they cease being employed in the navy or merchant service, engage in one or other of the fisheries. But such as are fishermen by profession are divided into two classes, of which the one are attached to the whale and cod fisheries, the other consists of those who fish along the coast and supply the towns that border upon it. The former embark from the ports of French Flanders, Normandy, and most of all, of Brittany; they are engaged during the earlier months of the year, and return in September or October. Such as do return, (for many perish,) generally have four or five hundred francs (from 16*l.* to 20*l.*) in their pockets, to assist them through the Winter. This they may increase by fishing off the coast, or by making nets for those who send out the fishing-vessels, working up the raw material with which the latter supply them, and are paid two or three hundred francs for their labour. From these different resources, a family of four or five persons is supported; and though with industry and good management a certain measure of comfort may be thus secured, there can be no laying up of any positive provision against future wants. Such is the condition of the French seaman, whether he serve his country at twenty-seven francs per month, or engage in the merchant service at forty-five francs.

Those who fish along the coast, though exposed, perhaps, to fewer risks than those who go to the whale-fishery off Cape Horn, or to the northern cod-fishery, are worse off in other respects. Landernau, Belle-isle, and some other ports on the coast of Brittany, are the chief stations for the sardine fishery; Cancale, Grandville, and Dieppe, are the same for oyster dredging, and the Channel ports in general for the herring and mackerel fishings. The first of these gives employment to about fifteen hundred boats, each manned with a crew of four,—the master, an experienced seaman, a novice, and a boy. They are engaged, for the most part, about the middle of November, for the following Spring, by merchants who

give them from fifteen to twenty francs for the whole fishing season; but over and above this, the master of each of the boats is entitled to a ninth-part of the fish that are caught, the mate is allowed a tenth, the novice a twentieth, while the boy has nothing at all. They have also a few furnishings, a little wine, wood for fuel to cook their victuals with, &c.; but, on the whole, these poor creatures have hardly enough to meet the first wants of nature, and on some parts of the coast their distress is extreme. Nothing can form a greater contrast with their condition than that of the fishing population of Holland, where, through the universal diffusion of an excellent Protestant education, from the independence and economy of all classes, and the wise combination of the interests of all in common enterprizes, family comfort and a sufficiency of food are found at all times, and universally, prevalent.

The men engaged in the oyster-fishery are not thus exposed to the hazard of actual want. These have the article they bring to market always within certain reach,—the oysters being attached to the fishing ground, from which they are detached by means of an instrument six feet long, somewhat like a shovel, with a kind of sack behind, made of cord or strips of leather. This, when dragged along the bottom of the sea, collects all that comes in its way. The oyster is found along the whole north coast of France, but is nowhere so plentiful as at Cancale and Grandville. Upwards of a hundred millions are taken up every year, and yet they seem more inexhaustible than ever. The oyster-fishery produces about fifteen millions of francs (about 600,000*l.*) a-year, and hence diffuses the means of easy subsistence at the two ports we have mentioned, whose population has lately advanced from 3500 to 5000 inhabitants. The oyster-dredgers are, generally speaking, better lodged, clothed, and fed, than any other class of seamen. The fishings are carried on with most activity during Winter; and in spite of the severity of the weather, it is not unusual for the men to spend several successive nights at sea.

Next to the Grandville and Cancale fishermen, those of the inhabitants of the coast of France, who seem to live most comfortably, belong to the Flemish and Channel ports; for their superiority in this respect, however, they are indebted not so much to their nets as to other petty branches of industry which they combine with fishing. The Flemings cultivate each a small spot of ground, or engage in the egg trade with England. The fishermen of Cherbourg, Fecamp, and St. Valery, rear pigs for selling to vessels going to sea, or engage in smuggling tobacco and snuff.

Unhappily there is one vice common to all the seafaring people along the French coast, from Dunkirk to Bayonne, and that is the abuse of spirituous liquors. In Flanders the men make themselves drunk with gin; in Normandy with cyder; in Brittany with brandy; in the Landes and in Gascony with wine. Drunkenness and ignorance are the two great evils that press down the labouring part of the population of the French coast. Even when drunkenness fails to brutalize them, ignorance makes them the victims of credulity and superstition. The hair-breadth and apparently-miraculous escapes of a seaman's life, together with the sublime aspect of the ocean continually present to him, might promote true religion in an enlightened person, but only render the ignorant man childishly superstitious, and engage him in practices not in the slightest degree calculated to improve his moral character. Hence those barbarous manners which from time immemorial have distinguished the shores of the ocean. The inhabitants have become habituated to the idea that a wrecked vessel is their lawful prey and a godsend. Nay, it is not many years since the inhabitants of Brittany, during storms, would allure ships to the coast by false signals, then plunder the cargoes, and sometimes murder the crews.

JUDICIAL COMBATS AND TRIALS BY ORDEAL.

THE custom of judicial combats, of which traces were discoverable in our laws until the beginning of the reign of George the Fourth, was introduced into civilized Europe by the barbarous tribes of Germany who overwhelmed the Roman empire. It appears to have been first legally established by Gondebald, king of the Franks, by an edict published at Lyons, March 29, A.D. 501, in which the monarch assigns his reasons for establishing, or rather sanctioning the institution: "Let causes be decided by wager of battle, to the end that rash oaths should no longer be taken respecting obscure facts, nor false oaths respecting certainties." What a singular picture of morals is contained in these few words; perjury had become so monstrous an evil, that murder was chosen as the milder alternative!

The judicial combat thus sanctioned by royal authority, was called the "judgment of God!" The Germanic tribes worshipped a deity who delighted in war and slaughter, and so deeply was this ancient creed impressed upon their minds, that it long resisted the influence of Christianity; the Romish clergy sanctioned the profanation of attributing to the Divine Being the character of the heathen deity, because it tended to increase their power by giving them a pretext for interfering in judicial trials. The forms of the legal combat were composed of the customs of savage life, combined with the corruptions of Christianity; religion and law were equally desecrated by being brought to preside in a field of blood. The rules of judicial combat are detailed at great length in the ordinances of various kings during the Middle Ages, but the following summary will be found amply sufficient for general readers.

When a plaintiff claimed a possession which the defendent refused to resign, or charged him with a crime which he denied, a challenge was the immediate result. Whichever of them appealed to the combat threw down before his adversary some pledge, usually a glove, which was called the gage of battle, and taking this up was the signal that the challenge was accepted. In later ages it was necessary to have the permission of the king or liege lord before a challenge could be given, but at first, the Suzerain had no right to interfere until called to preside at the combat or to name a president, and his power was limited to naming the place and time for the contest. When the challenge was accepted, each combatant named certain witnesses, called sponsors, or godfathers, "because," says an old historian, "they were about to attend a baptism of blood," and these called the champions their god-children! These sponsors, or seconds as they were subsequently called, were originally appointed to watch the combat, and see that its rules were fairly observed; but they soon began to join in the fight themselves, either to aid or to avenge their principals.

Application was next made to the Suzerain to appoint the umpire or president, and the time and place of the combat. A space called the "close-field" was marked out, and surrounded by ropes or palings. At the upper part of this little amphitheatre

a gallows or a pile of wood was erected, that the vanquished, if he escaped with life, might be instantly hanged or burned. In front of this were two seats covered with black, for the two combatants. Before entering the lists the combatants attended mass, and received the eucharist in the form prescribed for its administration to persons at the point of death; and so common were such events, that a special service was prepared for the occasion, called "the duellist mass," (*missa pro duello,*) which may be found in most ancient missals. When the service was concluded, the combatants were led by their god-fathers, accompanied by the heralds and clergy, to their seats in the lists, and a discourse was pronounced, usually by a priest, exhorting them not to tempt Providence if conscious of falsehood or injustice.

An oath was administered to each, in which they called to witness, God, the Virgin Mary, the Saints, and especially "that good knight and gentleman St. George," that their causes were just, and that they would not depart from them.

They next swore on the Gospels that they had used no sorcery, witchcraft, or magical incantations, and that they had not about them any spell, amulet, or charm. But not satisfied with the oath, the president, called usually "the marshal of the field," caused the combatants to be searched, and at the same time had their arms measured, so that neither should have an unfair advantage by length of weapon.

The marshal of the field, attended by the sponsors, then divided as fairly as he could the advantages of ground, sun, and wind, sometimes adding comfitures and other little sweets to serve as refreshments in the battle. The lists were then cleared, and the spectators prohibited from entering them under pain of death; severe penalties were also denounced against any person who should distract or interrupt the combatants by coughing, sneezing, speaking, or making any sound whatever. When these preliminaries were arranged, the marshal gave the signal for combat by dropping his truncheon, and saying to the sponsors, "Let the brave champions go."

In the earlier ages every combat was a duel "to the utterance," that is, until one or other of the champions was so disabled as to be unfit for continuing the fight. Defeat was condemnation, and when the subject of charge was a capital crime, the vanquished passed at once from the lists to the gibbet.

Judicial combats in France were carried to a greater extent than in any other European country. Not only could a challenge be maintained between the principals of a suit, but either of the parties might challenge one of his adversary's witnesses, or even the judge by whom the cause was tried, if dissatisfied with his decision. Ladies or ecclesiastics fought by proxy; if their champion was overthrown he was condemned to lose his right hand, and this penalty was rigidly enforced, in order that champions should fight as strenuously in the cause of others as they would in their own.

Wager of battle was a privilege peculiar to the nobles; those of lower rank were generally compelled to have recourse to ordeal. The most common form of ordeal was the trial by burning. The plaintiff or defendant claiming this form of process, appeared before an ecclesiastical judge and lifted up a bar of red-hot iron in his right hand. The hand was then bandaged and secured by a seal. At the end of three days the seal was broken and the bandage removed; if no marks of burning appeared the patient gained his cause, if otherwise, sentence was pronounced against him. This form was sometimes varied; the party was required to walk barefoot over a certain number of burning ploughshares, or to carry a burning horse-shoe to a given distance; if he did so without manifest injury he was declared to have gained his cause.

The trial by boiling water was conducted with great ceremony; a ring was consecrated and thrown into a cauldron of boiling water, and the party had to plunge his naked arm into the vessel and take out the ring without wincing. It was believed that there was more room for artifice in this ordeal than in any other; and it was therefore required that the water should be heated in the presence of competent witnesses, and that it should boil up before the holy ring was thrown into it.

The trial by cold water was the most dangerous to the patient. A priest blessed the water in some deep pond or reservoir, into which the party was thrown bound neck and heels. If he floated, it was considered that the consecrated element refused to receive the wretch, and if he sank, he ran a fair chance of being drowned. This was the favourite ordeal in the trial of witches; when any of these unfortunate beings floated, they were hurried to the stake or stoned by the brutal spectators.

The judgment of the cross was a form of ordeal patronized by an emperor so enlightened as Charlemagne. He ordained that in certain disputes, especially between children, the parties should hold their hands extended so as to represent a cross, and whoever first let their hands fall, was adjudged to have lost his cause.

Many examples of judicial combats are recorded in the old chronicles; we shall extract the description of one which took place in the presence of Louis the Second, king of France, surnamed the Stammerer, about A.D. 878, preserving as well as translation will permit, the style of the original historian.

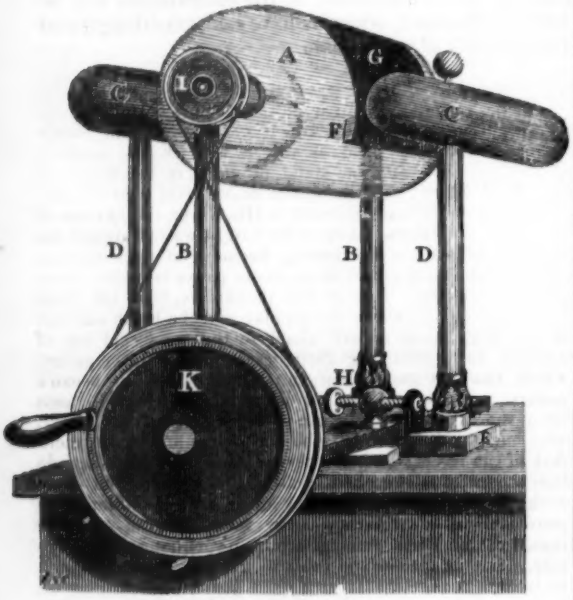
Ingelgerius, Count of Gastinois, was found one morning dead in his bed; one of his relations, named Goutran, accused his widow of the murder, and of other criminalities besides. Nobody appearing as champion for the lady, she summoned to her aid, Ingelgerius, Count of Anjou, whom she had held in her arms at the baptismal font, giving him the name of her husband, although he was not yet more than sixteen years of age. The count readily engaged to support his godmother's quarrel, and a day was fixed for the combat. On the appointed morning the young count heard mass, distributed alms to the poor, made an offering to the church, and fortified himself with the victorious sign of the cross; after which he proceeded to the lists, where Goutran stood prepared for the encounter. The lady of Gastinois was then summoned, and the usual oaths taken; the signal was given, and the champions met. Goutran struck the count so rudely that he cleft his shield in twain, but neither shield nor harness availed against the count's lance; he pierced Goutran through the body and threw him from his horse. The count then dismounted and cut off the head of the accuser, which he presented to the king, who received it as gladly as if it had been a city. The countess was immediately set at liberty, she bent her knee to the king, and then in the presence of the whole court threw her arms round her champion's neck and kissed him.

In the reign of William the Conqueror judicial combats appear to have been very common in England, for one of his laws forbids clergymen to fight duels without the previous permission of their bishop. But the feelings of the British people were averse to this barbarism, and, from the eleventh century, courts of law possessed more authority in England than in any other country.

THE study of truth is perpetually joined with the love of virtue; for there is no virtue which derives not its original from truth; as, on the contrary, there is no vice which has not its beginning from a lie. Truth is the foundation of all knowledge, and the cement of all societies.—CASAUBON.

ELECTRICITY.
No. III.
ELECTRICAL MACHINES.

BEFORE we enter upon a particular explanation of the varied phenomena which present themselves whilst pursuing a series of electrical investigations, it seems desirable that we give some account of *Electrical Machines*, on whose agency, under proper management, we depend for the successful prosecution of these interesting researches.



The adaptation of the several parts of an electrical machine, by means of which we obtain at pleasure large supplies of electricity, is a consequence of the knowledge we have previously attained of the habits of certain substances, when submitted to the process of electrical excitation. The instrument consists of non-electrics and electrics, or, as they are with equal propriety termed, conductors and non-conductors; so arranged that one part may be easily excited, and electricity made to accumulate on it, another part enabling us to give to the electricity so obtained any required direction, whilst a third effectually prevents its escape to the earth, until the precise moment we may have determined on.

Electrical machines are made of different forms. For ordinary purposes those of the most simple construction are the most generally useful; of which there are two kinds—the *cylindrical*, and the *plate*, machine. The former of these we shall first describe. It is made of various sizes; but we shall give the dimensions of the principal parts of one, which, by many years' practice, we know to be most convenient for experimental illustration.

Let A in the preceding figure represent a cylinder of glass, say about twelve inches in diameter, and twenty or twenty-four inches long. It must be made as nearly as possible of an equal thickness throughout its whole length, and the nearer it approaches to a perfect cylinder the better. The ends must be somewhat thicker than the sides, with which they should form an angle of about 10°.—B B are glass pillars firmly secured to a thick piece of mahogany, or some other hard wood, which should be about three feet long by two feet nine inches broad. The cylinder is mounted on these pillars, between which it revolves on an axis at each end; motion being communicated to it by means of a winch attacned to one of its axes (I), or more conveniently by the multiplying wheel, K. C C are hollow cylinders of metal, about eighteen inches long, and four inches in diameter. These are called *conductors*, and are fixed upon glass pillars D D, similar to those which support the glass cylinder, as already described. The pillars D D are not attached permanently to the frame-work of the machine, but are cemented into pieces of wood, one of which is shown at E, moving in a groove, and by means of adjusting screws (H) their positions are regulated as circumstances require. To one of the conductors is attached a cushion or rubber, F, about two inches wide, and nearly equal in length to the glass cylinder, against which it is made gently and uniformly to press, by a slender metallic spring at its back, aided by the adjusting screw H. The cushion is made of soft leather (either red or purple basil are the kinds commonly used), and is stuffed with horse-hair or wool. The former, on account of its greater elasticity, is the most preferable. The other conductor is furnished with a row of fine steel points, projecting about an inch from its side, and so arranged that they may be as close as possible, but without touching it, to the glass cylinder. To the upper side of the cushion F, is sewn a piece of stout green or black silk, slightly stiffened by being oiled. This flap of silk, G, extends from the rubber, across the surface of the cylinder, to within about three-fourths of an inch of the steel points just mentioned.

The conductor to which the steel points are attached is commonly called the *prime conductor*. As shown in the figure, it stands parallel to the cylinder; but in practice it is more convenient to place it at right-angles; in which case the points are fixed to the end nearest the machine, to receive the electricity which is given off at the opposite end.

The several parts of the electrical machine being thus arranged, we have no difficulty in understanding its principle, and the conditions on which its efficacy depends. Before, however, it can be pronounced ready for action, it must be ascertained that it is perfectly clean and dry. The glass pillars, which support the cylinder and conductors, must be carefully wiped with an old silk-handkerchief. Dust and other impurities should be removed from every other part of the instrument; and the cushion and silk flap being first cleaned, the former must have a little fresh *amalgam* spread on it.

As the energy of an electrical machine is increased or diminished by the qualities of the amalgam applied to it, we shall here give instructions for making that useful compound.

Take equal parts, by weight, of tin and zinc, melt them together in a crucible, or common iron ladle, and pour them upon three parts, by weight, of mercury, in a wooden box, which must be shaken until the metals are cold. When required for use, the amalgam must be pulverized, in a mortar, to a very fine powder, mixed with a small quantity of tallow or hog's lard, (we prefer tallow), and thinly spread on the cushion by means of a blunt knife.

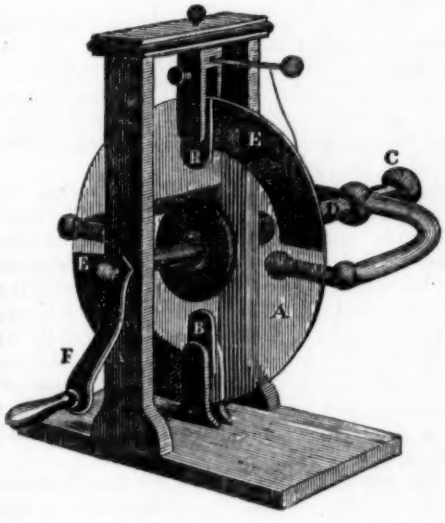
Now let us return to the machine, which we suppose to be properly cleaned and amalgamated; but which will disappoint our expectations, when we begin to operate with it, if the atmosphere of the room where it is placed be not warm and comparatively dry. Many persons are in the habit of placing an electrical machine opposite a fire previous to using it,—a plan we have never adopted, and which we consider as injudicious as it is unnecessary. With the utmost care it sometimes happens that by unequally heating the machine, either the cylinder or glass pillars are

fractured; whilst there is always the risk of softening the cement, and thus deranging some of the most important parts of the instrument.

In cold weather there should be a fire in the room in which we propose to perform electrical experiments, and the whole of the apparatus should be placed in the room, so that it may be all of the same temperature as the surrounding atmosphere. The doors, and especially the windows, of the room, should also be kept closed. At other seasons of the year, unless the external atmosphere is more than ordinarily damp, a fire in the room is not required; but the windows must not be opened.

It is by some persons recommended that the glass pillars and ends of the cylinder of the electrical machine should be coated with a resinous composition, resembling sealing-wax. This we consider a defect, rather than an improvement. If the different parts of the instrument are properly proportioned, and judiciously combined, there is no difficulty in rendering it effective; and the less encumbered the glass, or other parts, are with cement or varnish, the more easily can they be kept clean, and the more promptly may the machine be got into action.

In its essential arrangements, the *plate* machine resembles that we have been describing; and with this advantage, that it is more simple in its construction, more easily excited, and can be cleaned and kept in action with less labour. It is here represented



A is a circular glass plate, say twenty-four inches in diameter, and about one-fourth of an inch thick; made as true as possible, and mounted on an axis passing through its centre, which is supported at each end by a strong frame-work of mahogany, securely fixed to a broad base of the same material. Motion is given to the plate by turning the winch, F. B B are cushions or rubbers, made in the same manner as that for the cylindrical machine, but of a different shape; and there are four of them connected in pairs to the top and bottom of the frame of the instrument, so as to press equally on both sides of the plate. This is effected by means of a spring-frame, centre-pins, and adjusting-screws. E E are silk flaps attached to the rubbers, and united at their edges, so as to keep them in their places at the sides of the plate. C is the prime conductor, made of brass, about an inch in diameter, and somewhat of an elliptical form. It extends entirely across the plate, forming a curve at a considerable distance from it, and receives the electricity by pieces returned at each end, which are furnished with steel points. That part of the conductor most distant from the plate terminates in a large hollow sphere of brass, which has one or more holes in it for connecting the machine with various kinds of apparatus. The conductor is insulated, and sustained in its place by a large rod of glass, D.

The plate machine, as here described, is not so well adapted for illustrating the principles of the science of electricity as that of the cylindrical form. By a very trifling alteration, or rather addition, it may, however, be rendered equally useful. But this difference in the construction of the instruments will be better understood, when we have said something about the methods of using them.

It is a poor philosophy and a narrow religion, which does not recognise God as all in all. Every moment of our lives, we breathe, stand, or move in the temple of the Most High; for the whole universe is that temple. Wherever we go, the testimony to His power, the impress of His hand, are there. Ask of the bright worlds around us, as they roll in the everlasting harmony of their circles; and they shall tell you of Him, whose power launched them on their courses. Ask of the mountains, that lift their heads among and above the clouds; and the bleak summit of one shall seem to call aloud to the snow-clad top of another, in proclaiming their testimony to the Agency, which has laid their deep foundations. Ask of ocean's waters; and the roar of their boundless waves shall chant from shore to shore a hymn of ascription to that Being, who hath said, 'Hitherto shall ye come and no further.' Ask of the rivers; and, as they roll onward to the sea, do they not bear along their ceaseless tribute to the ever-working Energy, which struck open their fountains and poured them down through the valleys? Ask of every region of the earth, from the burning equator to the icy pole, from the rock-bound coast to the plain covered with its luxuriant vegetation; and you will not find on them all the record of the Creator's presence? Ask of the countless tribes of plants and animals: and shall they not testify to the action of the great Source of Life? Yes, from every portion, from every department of nature, comes the same voice: everywhere we hear Thy name, O God; everywhere we see Thy love. Creation, in all its length and breadth, in all its depth and height, is the manifestation of thy Spirit, and without Thee the world were dark and dead. The universe is to us as the burning bush which the Hebrew leader saw: God is ever present in it, for it burns with His glory, and the ground on which we stand is always holy.

How then can we speak of that Presence as peculiarly in the sanctuary, which is abroad through all space and time?—Francis.

Take heed that thou seek not riches basely, nor attain them by evil means; destroy no man for his wealth, nor take anything from the poor: for the cry and complaint thereof will pierce the heavens. And it is most detestable before God, and most dishonourable before worthy men to wrest anything from the needy and labouring soul. God will never prosper thee in aught, if thou offend therein: but use thy poor neighbours and tenants well, pine not them and their children to add superfluity and needless expenses to thyself. He that hath pity on another man's sorrow, shall be free from it himself; and he that delighteth in, and scorneth the misery of another, shall one time or other fall into it himself. Remember this precept, "He that hath mercy on the poor lendeth unto the Lord, and the Lord will recompense him what he hath given." I do not understand those for poor, which are vagabonds and beggars, but those that labour to live, such as are old and cannot travel, such poor widows and fatherless children as are ordered to be relieved, and the poor tenants that travail to pay their rents, and are driven to poverty by mischance, and not by riot or careless expenses: on such have thou compassion, and God will bless thee for it. Make not the hungry soul sorrowful, defer not thy gift to the needy, for if he curse thee in the bitterness of his soul, his prayer shall be heard of Him that made him.—Sir Walter Raleigh.

ON WRITING MATERIALS.

No. VII. On Ink.

When a material, such as paper or parchment, had been discovered, which by moderate care might be preserved through a course of ages, it evidently became an important object to employ an equally permanent and durable substance, wherewith to describe those characters which should reveal to future generations, the thoughts and proceedings of the men of other days. It were evidently of little use to have attained the one without securing the other also. If the paper be permanent, so also must be the ink; which latter condition, as far as manuscripts are concerned, has ever been of difficult attainment; nor are we sure that our best writing inks of the present day, are calculated to resist successfully the action of time.

The ink of the ancients seems to have been of a viscid, or oily, nature. Unlike the modern writing ink, it consisted of nothing more than colouring matter and gum. The chief ingredient was a species of soot, or ivory-black, mixed with one-fourth of gum. This mixture was formed into cakes or rolls, with the addition of a little water, and dried in the sun. A similar mode is practised at the present day by the Chinese, in their celebrated Indian Ink, which consists of nothing more than minutely divided carbon mixed with gum-water, and cast in a mould. This was the ink of the age of Dioscorides and Pliny, and continued in use until the seventh century. It was, probably, prepared for writing in a manner similar to the preparation of our water-colours for painting; but it was made more viscid, for the letters in ancient MSS. frequently appear in relief. Dr. Bancroft thus speaks of the writing-ink of Pliny, who lived in the first century of the Christian era.

Any person who will take the trouble of mixing pure lamp-black with water, thickened a little by gum, may obtain an ink of no despicable quality in other respects, and with the advantage of being much less liable to decay by age than the ink now in common use.

We must remark, however, that every black pigment mixed with gum or size, can be readily washed off the paper with water; and Pliny seems to have been aware of the fact, that unless inks sink into the surface of the papyrus, parchment, &c., they can be removed by washing. To obviate this defect, it was common in his age to use vinegar instead of water, for tempering the mixture of lamp-black and gum. An unstable sort of ink was used by Moses among the Jews, in certain ceremonials described in the law; and, in fact, eastern inks, at the present day, may be easily obliterated with a wet sponge. Mention is also made of *Golden Ink* in use among various nations, and among others by the Anglo-Saxons. Silver Ink was also not uncommon. Red Ink was made of vermilion or cinnabar. Purple Ink is very often found in MSS., but none are written entirely with ink of that colour. Capital letters were often written with an ink composed of vermilion and gum. Green Ink was rarely used in charters, but often in Latin MSS., especially those of the later ages. The guardians of the Greek emperors employed Green Ink for writing the signatures of the princes until the latter came of age. Blue and Yellow Inks are sometimes found in MSS. Yellow Ink has probably not been in use for 600 years. In some MSS. metallic and other characters are varnished. Wax was used as a varnish by the Latins and Greeks, but more by the latter. This covering, or varnish, is common in MSS. of the ninth century.

The word *Sepia*, or the *cuttle-fish*, is used by some Latin authors for ink, because this fish, when afraid of being caught, discharged a black matter, in order to conceal itself, which the Romans sometimes used for ink.

Of the various specimens of Black Ink which we meet with in MSS., that used by the Anglo-Saxons, in the eighth and two following centuries, preserves its original blackness much better than that of succeeding ages, not even excepting the sixteenth and seventeenth centuries, in which it was frequently very bad. Pale and decayed ink rarely occurs at any time previous to the last four centuries.

Du Cange says, that the emperors of the East wrote with Red Ink, preserved in a golden ink-horn set with gems. He also mentions a black or dark-coloured ink, made of silver and lead, by which the cavities in sculpture were marked.

Black Books, or Books of Necromancy, were coloured with a peculiar blackness, and the letters were believed to be the effigies of animals.

We come now to speak of modern Inks, which may be considered under the following heads: 1st. Indian Ink; 2nd. Printers' Ink; 3rd. Writing Inks; 4th. Sympathetic Inks, including Marking Ink. In the first three varieties only black, red, and blue are known of in common use, but some printers employ ink of various colours.

1st. Indian Ink, or more properly China Ink, is used in China for writing with a brush, and for painting upon the soft flexible paper of Chinese manufacture, which we have already described. The manufacture of China Ink was long kept secret, but there is now no doubt of its composition. Lamp-black and size, or animal glue, or gum, are the necessary ingredients, although perfumes and other substances, not essential to its quality as an ink, are sometimes added. The fine soot from the flame of a lamp or candle, collected upon a cold plate held over the flame, and mixed with pure size made from clean parchment, will afford an ink equal to any that is imported.

2nd. The making of Printers' Ink is a distinct branch of trade in itself. The Printers' Ink-maker is not a printer, nor does he make any one of the varieties of Writing Ink.

Printers' Ink may be called a black paint. It is smooth and uniform in its composition, of a firm black colour, and is remarkable for the singular facility with which it adheres to paper that is thoroughly moistened. Hence it is that the printer always wets his sheets before printing; and the reader will have no difficulty in calling to mind instances of wet newspapers, damp books, pamphlets, &c., dampness being always associated with the freshest wares of the publisher.

Printers' Ink consists essentially of oil and carbon, in a state of minute division. The tenacity of the oil is greatly increased, and its greasiness diminished, by means of fire. Ten or twelve gallons of oil are boiled in a twenty-four gallon iron pot and set fire to. The vessel must be of this size to prevent its contents from running over, since they swell up considerably in boiling. It is suffered to burn for half an hour or more, and the flame being then extinguished by covering the vessel closely, the boiling is continued with a gentle heat until the oil has attained the necessary degree of consistency; in this state it is called *varnish*. It is found necessary to have two kinds of this varnish, a thinner and a thicker, depending upon the shorter or longer boiling, to be mixed as occasion may require, since that which answers well in hot weather becomes too thick in cold; and, besides this, large characters do not require so stiff an ink as small ones.

The thickest varnish, when cold, may be drawn into threads like weak glue, and by this the workman judges of the due boiling, small quantities being from time to time taken out of the boiling pot, and dropped upon a cold tile. The oil loses from one-tenth to one-eighth of its weight by being boiled into the thick varnish.

Lamp-black is the common material to be added to the varnish for a black ink, in the proportion of two ounces and a half to sixteen ounces of the varnish. Vermilion is employed instead of lamp-black for Red Ink. The varnish and the colour are ground together on a stone with a muller, in the same manner as oil-paints are prepared. It is said that new oil cannot be prepared into varnish without the addition of turpentine. Some makers also add black resin and hard soap to the varnish when it has done boiling. We have also heard of treacle being employed to relax the ink a little.

The ink used by copper-plate and lithographic printers differs somewhat from common printing-ink, in being less adhesive; and, in preparing it, the oil is not boiled so long. A little indigo and rose-pink are sometimes added to these inks.

3rd. As an example of the formation of common writing-ink, the reader may dissolve a crystal of sulphate of iron (green vitriol) in a little water, and bruise a nut-gall; then pour a little boiling water on it; this will give him an infusion of galls, a little of which may be added to clear water. If this be mixed with the solution of sulphate of iron, an intensely black compound will result, which is considered by some chemists to be a compound of gallic acid and oxide of iron, or gallate of iron. This substance not being very soluble in water, will subside to the bottom of the vessel containing it, but this subsidence is prevented in practice by the addition of gum-water.

Good Writing Ink may be formed by observing the following directions, which the writer of this article has employed for some years. Take eight ounces of Aleppo galls, in coarse powder, four ounces of logwood, in thin chips, and boil them together in twelve pounds of rain or distilled water for one hour, or one hour and a half; strain the decoction through a hair-sieve; then add four ounces of sulphate of iron, three ounces of powdered gum-arabic, one ounce of sulphate of copper, and one ounce of sugar-candy; stir the mixture until the gum is dissolved, then leave it to rest for twenty-four hours; pour off the clear portion into a stoneware bottle; add about six drops of kreosote, which will effectually prevent the ink from getting mouldy, and then let the bottle be well corked.

In these directions the sulphate of copper may be omitted; the only objection against using it is, that, in mending a moist pen, the ink coming in contact with the penknife coats it with copper whenever such contact is made; but the use of the sulphate of copper contributes to the durability of the ink, and tends to prevent mouldiness.

Some makers recommend that the sulphate of iron should be calcined to whiteness, that acetate of copper be employed instead of the sulphate of that oxide, and that vinegar be employed instead of water; but we have found no advantage from these variations, but, on the contrary, some disadvantage; for the acid of the vinegar tends to soften the pen if a quill be used, and to corrode it if it be a steel pen; so that we cannot recommend vinegar as a menstruum for the colouring materials.

The colour of Writing Ink is effectually destroyed by chlorine; but this powerful agent does not act upon Printers' Ink, on account of the large quantity of carbon contained in the latter. Many complaints are brought against writing ink, which ought to be applied to the writing-paper on which it is used. Such paper made from inferior rags, bleached by an excess of chlorine, discolours the best ink. The obvious test of good ink is, therefore, to write with it on writing-paper of various kinds, and observe the permanency and blackness of the letters after a considerable lapse of time.

Red Ink may be obtained by boiling a quarter of a pound of the best logwood with an ounce of alum and an ounce of cream of tartar, in about a quart or three pints of water; strain it and add immediately sugar and gum-arabic, of each one ounce. Another recipe is to steep one pound of Brazil wood, and one ounce of cochineal, in two gallons of vinegar for twelve hours, then to add four ounces of alum and one ounce of lump-sugar; let it simmer for one hour, then strain and preserve it for use.

It must be remarked that in the preparation of red ink metal vessels must not be employed, as they will be corroded by the action of the acids.

Blue Ink, employed for the faint lines in copy-books, ledgers, &c., is obtained from a solution of indigo in sulphuric acid; the corrosive nature of the acid is removed by the addition of alum, and the ink made fluid and permanent by gum-water.

4th. Sympathetic Inks have been employed occasionally in secret correspondence. The paper is written upon with one of these inks; and the writing remains invisible when dry, and can only be read by adopting for each ink a peculiar contrivance, which we will notice as we proceed.

Many amusing experiments may be tried by the young chemist on this subject; and as the inks are easily made, and their efficacy easily tested, the following directions will suffice.

1. Write with a weak infusion of galls: the writing will be invisible; but if the paper be moistened with a weak solution of sulphate of iron, the writing will appear black. 2. If paper be soaked in an infusion of galls, and dried, a pen dipped in a solution of sulphate of iron will trace black characters on that paper, but colourless ones on any other paper. 3. A dilute solution of nitrate of silver remains colourless in the dark, or by candle-light. If exposed to the sunshine for a minute or two it becomes black. 4. Write with a solution of sulphate of copper; it will become visible by dipping it in ammonia or strong hartshorn. 5. Solution of prussiate of potash affords blue letters when moistened with sulphate of iron. 6. The solution of cobalt in nitromuriatic acid, when diluted, affords an ink which becomes green when heated, and remains invisible when cold. This ink has been used in painting hand-screens, &c. The scene represents a wintry landscape, the ground and houses covered with snow, the trees destitute of foliage. On holding this to the fire, the snow appears to melt, the green grass to appear, the leaves to cover the trees, and summer to have resumed her dominion. On removing the landscape from the warmth of the fire, winter again appears to return. 7. A solution of equal parts of sulphate of copper and muriate of ammonia gives a yellow colour when heated, which disappears when cold.

There are many more sympathetic inks; but these specimens will suffice to show their nature and the methods of preparing them.

Marking Ink, or as it is sometimes called, *Indelible Ink*, for writing on linen, may be prepared by dissolving two drachms of nitrate of silver, and one drachm of gum-arabic, in seven drachms of distilled water, coloured by a little China ink. The cloth to be

written on must first be moistened with a solution prepared by dissolving two ounces of carbonate of soda, and two drachms of gum-arabic, in four ounces of water. The cloth wetted with this solution must be dried before the letters are written. The cloth is then exposed to the light, which, with the assistance of the carbonate of soda, decomposes the salt of silver, and a black oxide of silver remains firmly united to the cloth.

Although this ink has been termed *indelible*, it can easily be removed by washing it in strong ammonia.

When ink falls upon linen, there is, after washing, a yellow-brown spot left, which is called *iron-mould*. To remove this, an expensive article, called by the absurd name of *Essential Salt of Lemons*, is sold. This salt consists of oxalic acid and potash, or oxalate of potash. The iron of the ink forms the stain upon the linen; and with this iron the oxalic acid and the potash combine, forming an oxalate of iron and potash, which is washed out by the action of water. The box of salt of lemons, which is often sold for two or three shillings, is not really worth more than as many pence, and need never be purchased under its expensive name.

CHAIN LINKS OF VARIOUS FORMS.

AMONG the numerous useful applications of that valuable metal, iron, its substitution for hempen ropes, when formed into chains, is one of great import. The manufacture of iron, and other metals, into chains is of great antiquity. At first, perhaps, chains were merely an ornamental arrangement of copper, gold, or silver wire, for the decoration of persons of distinction. Iron chains were, however, used by the Romans for other purposes. They formed part of the *materiel* of the army, and were employed to bind or degrade captives made during their warlike enterprises. In what manner chains were formed in those early days, whether by welding, or by merely bending the wire, is uncertain.

The extensive employment of iron chains in machinery, and on ship-board, at the present day, has led to great improvements in their construction. The simplest kind of chain is the following, Fig. 1. This is frequently employed in jewellery; but unless the wire is strong, the chain is extremely fragile, the links opening at the slightest pull. Figs. 2 and 3 are representations of the patterns of other chains of the same slight description.

Fig. 1.

Fig. 2.

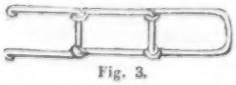


Fig. 3.

The first improvement in the formation of a chain in which strength was required, was the soldering or welding together of the links, and the usual form of these links was an oval, Fig. 4; and for all common purposes this pattern is still in use. In the case of iron chains, when the metal is united by welding, the workman having made the iron rod, of which the links are to be formed, red hot, cuts off with a chisel as much as is necessary to form one link. Having again heated this piece, he bends it into the form of a letter U over the beak of his anvil. He then heats the two ends of the link to a welding heat, and unites them by hammering; and forming the second link, he proceeds in the same manner, excepting that he introduces the new link into that last formed, before he welds together the two ends. The dexterous manner in which a good workman will join the links of a chain in this manner is quite surprising to those unaccustomed to see works of this nature performed.

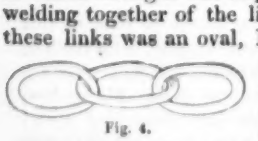


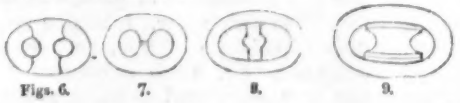
Fig. 4.

As chains of this kind would naturally wear out at those points where the links were in contact much sooner than at the sides, the plan of making the ends of the oval thicker than the sides was resorted to; and to save the workman's labour in reducing the iron in thickness in the necessary places, a machine was invented by which the iron was reduced in the proper manner, by passing it through steel rollers, so that the chain-maker had no more labour in making the improved link than one of the common sort.

Fig. 5 is a piece of the prepared iron, and a piece cut off from A to B is sufficient to form one link.

Fig. 5.

When chains made after either of these plans are subjected to an excessive great strain, their sides are apt to be brought together, and when that occurs, the freedom of movement of the train is impeded, and the chain becomes entangled. To prevent this occurring, several means were fancied, by placing stays of different forms across the link, so as to prevent it collapsing. Figs. 6, 7, 8, 9, show several of these contrivances.



Figs. 6. 7. 8. 9.

A very curious chain, or metal rope, is employed in some of our collieries. It is made of wire, three-eighths of an inch thick, twisted into coils, as in Fig. 10.

Fig. 10.

The chain of a watch is very curiously constructed. Fig. 11 is an enlarged view of several of the links. A chain of this description, made on a larger scale, is used in coal-mines, as well as another of the following construction. (Fig. 12.)

Fig. 11.

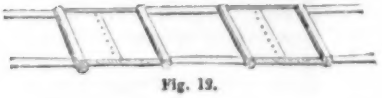


Fig. 12.

HE who is wise enough in youth to take the advice of his seniors, unites the vivacity and enterprise of early, with the wisdom and gravity of latter life; and what can you lose by at least asking their opinion, who can have no abstract pleasure in misleading you; and who can, if they please, furnish you with a chart of that ocean, to many unexplored, but over which they have passed, while thousands have perished there for want of that wisdom they are willing to communicate to you. The ancients fabled part of this lesson in the history of Phaëton, who vainly attempted to guide the chariot of Apollo. The world is too much for juvenile sagacity, and he must have become grey-headed who is wise enough to walk in and out amidst the machinery of Nature, and the subtleties of human life, without being either crushed by the one, or duped by the other.—ANDREWS.

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